Task: Portrait Gallery of the X-ray Universe

Alignment of Performance Task with National Standards

Grade Level: 9-12

Specific skills and knowledge demonstrated by the task:	**Alignment with Project 2061 Benchmarks for Science Literacy**	**Alignment with National Science Education Standards**
Students' ability to describe the X-ray portion of the electromagnetic spectrum.	**4F- Motion (9-12)#3:** …A great variety of, radiation is in the form of electromagnetic waves: radio waves, microwaves, radiant heat, visible light, ultraviolet radiation, x-rays, and gamma rays. These wavelengths vary from radio waves, the longest, to gamma rays, the shortest....	**Standard B Physical Science: Interactions of Energy and Matter#2** …Electromagnetic waves include radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, x-rays, and gamma rays…
Students' ability to describe the technology, tools, and data scientists use to learn about the universe.	**4A-Universe (9-12)#3**: Increasingly sophisticated technology is used to learn about the universe. Visual, radio and x-ray telescopes collect information from across the entire spectrum of electromagnetic waves; computers handle an avalanche of data and increasingly complicated computations to interpret them....	**Standard A- Inquiry (9-12)- Understandings About Scientific Inquiry-** Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science.
Students' ability to describe vast distances in the universe.	**4A- Universe (9-12)#2:** …Light from the next nearest star takes a few years to arrive. The trip to that star would take a rocket ship thousands of years. Some distant galaxies are so far away that their light takes several billion years to reach the earth. People on earth, therefore, see them as they were that long ago in the past.	**Unifying Concepts and Processes- Constancy, Change, and Measurement-** concepts of scale including speed of light.
Students' ability to accurately describe the structure and/or evolution of cosmic objects in the universe seen through Chandra.	**4A Universe (9-12)#2** … Eventually, some stars exploded producing clouds containing heavy elements from which other stars (and presumably planets orbiting them) could later condense. The process of star formation and destruction continues.	**Standard D: Earth and Space- The Origin and Evolution of the Universe-** …Billions of galaxies, each of which is a gravitationally bound cluster of billions of stars, now form most of the visible mass in the universe…Stars produce energy from nuclear reactions, primarily

		the fusion of hydrogen to form helium, These and other processes in stars have led to the formation of all the other elements.
Students' ability to create a visual representation of a cosmic object.	**11B Models (See Essay p267)** "Students need to acquire images and understandings that come from drawing, painting…"	**Unifying Concepts and Processes- Evidence, Models, and Explanation-** Models are tentative schemes or structures that correspond to real objects, events, or classes of events, and that have explanatory power…Models take many forms…
Students' ability to communicate scientific information accurately and effectively to the public.	**12D Communication Skills (see Essay p 295)** Translating scientific ideas to the general public.	**Standard A: Inquiry-Communication:** …accurate and effective communication including expressing concepts, reviewing information, summarizing data, using language appropriately, developing diagrams and charts…